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ABSTRACT

Sixty undergraduate students read and summarized eight short passages in a study of how semantic components were involved in text comprehension. After the first summary was completed (the naive or untutored summary), the students were assigned to one of three groups. The experimental group was introduced to the semantic components, including agent, event, patient, instrument, result, and descriptive. One control group was tutored in a 'traditional' method, stressing 'topics' and 'main points.' The second control group was untutored throughout the task. When the naive summaries were evaluated, the better summaries contained significantly higher proportions of the semantic component information. Analyses of variance showed that the experimental group summaries were significantly better than the summaries by the traditional and the untutored groups. It seemed clear that the 'natural' categories of semantic components identified certain types of judgments that were more accessible to processing needs than the less natural concepts of 'topic,' 'main points,' 'grammatical subject,' and 'direct object.' Thus, instruction in using semantic categories helped readers sift more efficiently through the potential information in a passage, allowing them to integrate the important information more completely. (RL)

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The Effects of Knowledge
of Semantic Components of Discourse
on Summarizing Text^{1,2}

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Purpose:

The purpose of this study was a) to find more evidence that semantic components, similar to those in case grammar, are intimately involved in comprehension, and b) to help college students isolate important information in text.

Background:

Although linguists have traditionally concentrated on the study of syntax and sentences, there has been a growing interest in the study of semantics and text. Much of the modern research in semantics was stimulated by Fillmore's (1968) case grammar of sentences. This interest in semantics has been extended more recently to the study of discourse (Grimes, 1972).

Very little research has been done concerning the relationship between semantic components and comprehension. The research that is available appears to be concerned primarily with psychological aspects of semantic components. Suci and Hamacher (1972), for instance, found that semantic categories affected the speed with which questions about sentence nouns could be answered. Questions about agents were answered more quickly than questions about patients (also called "objects"), and this effect was more important than effects due to a noun's position in a sentence or grammatical category (viz., subject or object). Shafto (1973) found that a novel sentence was often "recognized" if the semantic relations of an earlier sentence were preserved. Thus, subjects might "recognize" the novel sentence, "John borrowed \$100 from the bank," if the sentence they had actually seen earlier was "The bank loaned John \$100." Meyer (1971, 1973) demonstrated that the logical structure of the meaningful units in a passage strongly affected the pattern of recall. Identical units were more likely to be remembered when they occurred high in the hierarchical tree structure of a passage than when they occurred low in the hierarchy.

From studies like the ones mentioned above, an argument can be made for the psychological reality of case-like semantic components. Assuming their psychological reality, these semantic components may have educational applications. Meyer's (1971, 1973) methods, for example, could be used by writers of instructional materials to emphasize the information they want readers to remember. Alternatively, one might teach readers about semantic categories, which should improve their

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understanding of language and communication and thus improve their comprehension. In an earlier study (Christopherson, 1974), it was found that knowledge of semantic components of discourse significantly improved delayed recall, presumably because comprehension was improved.

Hypothesis:

Assuming that semantic components represent important information in discourse, it was hypothesized in the present study that:

- 1) Naive summaries which were subjectively judged "better" would contain more semantic component information than summaries judged "not as good."
- 2) Summaries written by college students who were introduced to semantic components would be better than those written by other students.

Methods:

Sixty Cornell undergraduates from an introductory general psychology course volunteered to participate in the experiment, for which they received extra credit in their course. The subjects were randomly divided into three treatment groups. The experiment was administered to the subjects in groups of up to five people. All subjects read and summarized eight short passages, which had been chosen from a college-level developmental reading program (Glock, in press). The passages contained an average of fifty words and were presented in four different orders.

There was no tutoring before the summary of the first passage. After reading and summarizing the first passage, the experimental group was introduced to the following semantic components: agent (who or what performs or causes the event?), event (what is the event or activity?), patient (who or what is directly affected by the event?), instrument (what is used to perform or cause the event?), location (where does the event take place?), result (what is the result or outcome?), and descriptive (what important descriptions and identifications are given?). The experimenter gave examples of the components from the first passage and read an appropriate summary using this information. For each succeeding passage, the experimental subjects were asked to list information which corresponded to the semantic components and to write a summary using this information. After each passage was summarized, the experimenter suggested appropriate component information and read a corresponding summary.

One of the control groups, after summarizing the first passage, was tutored with a "traditional" method, stressing "topics" and "main points." The experimenter gave examples of the topic and main points from the first passage and read an appropriate summary using this information. Each time a passage was summarized, the experimenter suggested an appropriate topic and main points and read a corresponding summary. All topics, main points, and summaries for the traditional group were taken from the same source as the passages (Glock, in press).

A second control group was untutored. They were simply asked to read and summarize each passage.

In order to score the summaries, the experimenter and another judge divided the passages into "idea units," which were essentially clauses. Six naive undergraduates, from the same subject pool as the experimental subjects, were asked to judge independently which idea units in each passage were most important. When four or more of these undergraduate judges agreed on a particular idea unit, it was counted as important.

The first summary by each subject was naive, i.e., untutored. These summaries were paired according to length, with the difference in each case being no more than five words. The six undergraduate judges were asked to select which of each pair was a "better" summary of the original. When four or more judges agreed, a summary was considered "better" for the purpose of testing hypothesis 1.

In order to compare summaries to test hypothesis 2, a lenient criterion was used to determine which idea units were included, and a formula was devised for assigning scores. Assuming that the better summaries are those which include more of the important idea units while using fewer words, a formula was constructed using the proportion of important ideas (a power ratio) multiplied by the ratio of important ideas mentioned to the total number of words used (an efficiency ratio). For example, a summary which mentioned nine out of twelve possible important ideas and which used a total of 45 words would have a score of $9/12 \times 9/45 = 0.15$. It was assumed that higher scores indicated better summaries.

The eight summaries for each subject were grouped into four consecutive pairs (see Table I), and a summed score for each pair was used in the analysis (except for the first pair, consisting of a naive summary and a practice summary, which was not included in the analysis). This permitted all cell means to be based on the same eight passages.

TREATMENT	ORDER	Ss	TRIAL			
			1	2	3	4
	1	5	A B	C D	E F	G H
	2	5	H D	B A	C G	F E
	3	5	E F	H G	D A	C B
	4	5	G C	F E	B H	D A
Traditional	ditto		ditto			
Untutored	ditto		ditto			

Table I: Experimental design. Subjects read and summarized passages A-H in one of four orders.

Results:

To test hypothesis 1, naive summaries were scored for the presence of the same component information that was used for the experimental tutoring. A t-test with matched pairs of summaries has a significance of $p < 0.01$ ($t = 2.736$, $df = 21$) favoring the "better" naive summaries. Means are 0.82 and 0.71 for the

"better" and "not-as-good" summaries, respectively. The subjectively "better" naive summaries contain a significantly higher proportion of the semantic component information.

To test hypothesis 2, a two-way analysis of variance (Barr and Goodnight, 1972) was performed, giving a $p < 0.02$ (See Table II). The means are 0.33, 0.28, and 0.27 for the experimental, traditional, and untutored groups, respectively. Using a contrast suggested by Winer (1971, p. 385), the experimental group is found to be significantly better than the traditional group ($t = 2.232$, $df = 57$, $p < 0.025$) and than the untutored group ($t = 2.810$, $df = 57$, $p < 0.005$).

Source	df	SS	MS	Tested by	F	$p <$
Treatments	2	0.1418	0.0709	Error A	4.390	0.02
Trials	2	0.0007	0.0003	Error B	0.047	0.95
Trials x Treatments	4	0.0292	0.0073	Error B	1.015	0.40
Error A (Subjects nested in Treatments)	57	0.9203	0.0161			
Error B (Trials x Subjects nested in Treatments)	114	0.8216	0.0072			
Total	179	1.9136	0.0107			

Table II: Analysis of variance summary. Important idea units determined by the agreement of at least four judges.

If the important idea units are determined by a more stringent level of agreement (at least five of the six undergraduate judges), then the probabilities favoring the experimental group are improved. A two-way analysis of variance gives $F = 5.015$, $p < 0.01$ (see Table III). The means are 0.29, 0.25, and 0.24 for the experimental, traditional, and untutored groups respectively. Again using the contrast suggested by Winer, the experimental group is found to be significantly better than the traditional group ($t = 2.411$, $df = 57$, $p < 0.01$) and than the untutored group ($t = 2.993$, $df = 57$, $p < 0.005$).

Source	df	SS	MS	Tested by	F	p $\angle$
Treatments	2	0.1056	0.0528	Error A	5.015	0.01
Trials	2	0.0000	0.0000	Error B	0.002	1.00
Trials x Treatments	4	0.0566	0.0142	Error B	1.663	0.16
Error A (Subjects nested in Treatments)	57	0.6002	0.0105			
Error B (Trials x Subjects nested in Treatments)	114	0.9709	0.0085			
Total	179	1.7334	0.0097			

Table III: Analysis of variance summary. Important idea units determined by the agreement of at least five judges.

Discussion and Conclusion:

"Better" naive summaries were found to include significantly more information from the different semantic components. Tutoring students to include more of this information in their summaries helped them to write significantly better summaries than traditionally tutored and untutored students.

The differences between the experimental and traditional groups are not likely to be due to differences in the exemplary summaries used for tutoring. The summaries were scored, and a t-test with matched summaries ($t = 0.539$, $df = 7$, $p \angle 0.70$, two-tailed test); the means are 0.22 and 0.20 for the experimental and traditional summaries, respectively.

From the present experiment and an earlier study (Christopherson, 1974), it is clear that an important psychological and educational phenomenon has been detected. A model to account for the results may ultimately be complex, but at this stage it seems relatively simple. According to Fillmore, (1968, p. 24), semantic components, like the ones in this experiment, "comprise a set of universal, presumably innate concepts which identify certain types of judgment human beings are capable of making about the events that are going on around them." In other words, these categories are "natural" and should be more accessible to an individual than less natural concepts such as "topic" and "main points" or even "grammatical subject" and "direct object." Thus, instructions to attend to semantic categories may help readers sift more efficiently through all of the information potentially available in a passage and permit them to integrate the information more completely.

The experiment outlined above was a practical and novel application of concepts adapted from theoretical developments in psycholinguistics. The results suggest that students in reading programs and English courses might benefit from the teaching of semantic components of discourse, although further research will be needed before this becomes a clear implication.

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